

# InGaAs Photomultiplier Chip Photon Counting Array for 1550 nm Operation, Phase I

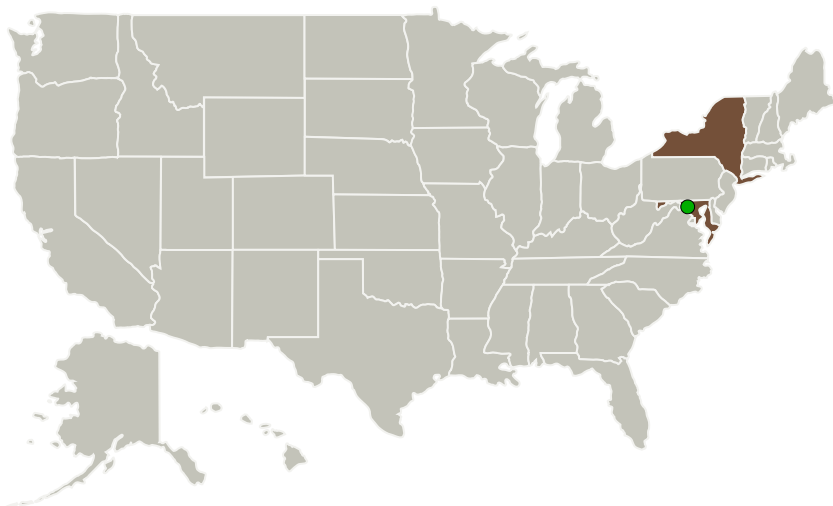
Completed Technology Project (2017 - 2017)



## Project Introduction

The development of a robust approach for Deep Space Optical Communications is critical to future space missions as communication bandwidth requirements are expected to dramatically increase due to continuing improvements in sensor spectral coverage and resolution. Current solutions do not meet NASA's goals for sensitivity, timing resolution, and data rate. Furthermore, many of the current solutions require cryocooling, which significantly impacts size, weight, and power, as well as reliability. LightSpin Technologies proposes the development of a new generation of single photon avalanche diode (SPAD) array devices to fulfill NASA requirements. The innovation includes a new planar processing technology, enabling tight pitch SPAD arrays to be built, mitigating after pulsing and dead time limitations. Furthermore, we propose to use InAlAs gain regions, which have significant advantages due to its avalanche breakdown characteristics and wider band gap compared to InP. The net result at the end of Phase II will be a Photomultiplier Chip SPAD array device incorporating thousands of small area SPAD devices in parallel, enabling precision detection of single photons with sub 100 picosecond timing resolution and maximum count rates in excess of 10 Gcps.

## Primary U.S. Work Locations and Key Partners



**Phase 0: GaInP SPAD array 11  $\mu\text{m}$  pitch**

**Phase II: InGaAs/InAlAs SPAD array 15  $\mu\text{m}$  pitch**

Q2 Q1

Q3 Q4

480  $\mu\text{m}$

InGaAs Photomultiplier Chip photon counting array for 1550 nm operation, Phase I Briefing Chart Image

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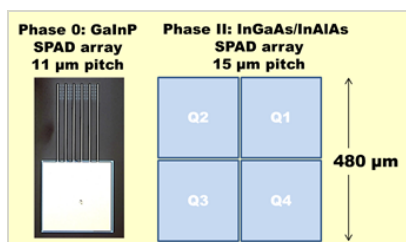


Organizations Performing Work	Role	Type	Location
LightSpin Technologies, Inc.	Lead Organization	Industry Small Disadvantaged Business (SDB)	Endicott, New York
● Goddard Space Flight Center(GSFC)	Supporting Organization	NASA Center	Greenbelt, Maryland

## Primary U.S. Work Locations

Maryland	New York
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## Images



## Briefing Chart Image

InGaAs Photomultiplier Chip photon counting array for 1550 nm operation, Phase I Briefing Chart Image

(<https://techport.nasa.gov/image/133291>)

## Organizational Responsibility

## Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

## Lead Organization:

LightSpin Technologies, Inc.

## Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

## Program Director:

Jason L Kessler

## Program Manager:

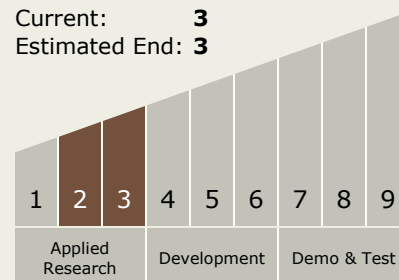
Carlos Torrez

## Principal Investigator:

Eric Harmon

## Technology Maturity (TRL)

Start: 2  
Current: 3  
Estimated End: 3



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## Technology Areas

### Primary:

- TX05 Communications, Navigation, and Orbital Debris Tracking and Characterization Systems
  - └ TX05.1 Optical Communications
    - └ TX05.1.1 Detector Development

## Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System